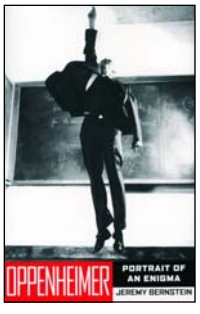
Chronicle of a Complex Physicist

Oppenheimer: Portrait of an Enigma

Jeremy Bernstein
Ivan R. Dee, Chicago, 2004. $25.00 (223 pp.). ISBN 1-56663-569-1

Reviewed by Steven Weinberg

Jeremy Bernstein is as good a writer as you can find among scientists. I would look forward to reading any biography written by him, even if the subject were Millard Fillmore, or Liberace. All the better if the subject is J. Robert Oppenheimer. He was one of the very few American theorists who participated in the quantum mechanics revolution in the 1920s; in the 1930s, he pioneered the theory of neutron stars and black holes. Though not in a class with Paul Dirac or Wolfgang Pauli, Oppenheimer in his day was one of the leaders of theoretical physics.



But of course it is as a public figure that Oppenheimer is so interesting. Under his direction, the secret laboratory at Los Alamos designed and built the nuclear weapons that ended World War II. After the war, he became the head of the Institute for Advanced Study in the glory days when the Institute housed Kurt Gödel, George Kennan, John von Neumann, and Hermann Weyl, as well as Albert Einstein. As chairman of the General Advisory Committee of the Atomic Energy Commission, Oppenheimer continued to advise on nuclear policy at the highest levels of government. Then, after he faced a government hearing rivaling the trials of Saint Joan and Charles I for drama, his security clearance was revoked.

All this made Oppenheimer a world celebrity. I remember in 1962 my wife and I were sitting in a café in Geneva during a break at the "Rochester" High-Energy Physics Conference, then in town. Looking at the other café patrons, we decided that they must be diplomats—they spoke languages we couldn't identify, and they were much too well dressed to be physicists. For a moment I felt that although I loved physics, in choosing a career in research, I had given up the glamour of the great world of national and international affairs. Then Oppenheimer came in. He stopped at our table and chatted with me for a few minutes about some of the talks at the conference. After he walked away, one of the diplomats, wearing a gorgeous tarboosh and fez, came over and said, "Pahdon me, sah, but was that Doctah Oppenheimah?" My self-pity passed: I didn't have a diplomatic passport, but at least I knew Oppenheimer.

Bernstein's new book is a splendid, brief biography of Oppenheimer originally intended as a *New Yorker* profile. Bernstein is very good at describing the physicist's strengths. Oppenheimer had the ability to understand anything—all the work being done in every department at Los Alamos and then, after the war, everything going on at the frontier of theoretical physics. When I was a graduate student at Princeton, I used to go over to Building E of the Institute for Advanced Study to attend physics seminars. Oppenheimer always sat in the front row, asking questions that demonstrated he knew as much about the speaker's subject as the speaker. Of course he was showing off, but no one else could have gotten away with it. He did know as much as the speaker.

Oppenheimer was wide open to new ideas and did what he could to advance the work of younger theorists whose ideas impressed him. He recruited a stellar group of new members to the Institute, including theoretical physicists Freeman Dyson, Bram Pais, Frank Yang, and (briefly) T. D. Lee. Until reading Bernstein's book I hadn't known that as early as 1943 Oppenheimer had tried to get the University of California, Berkeley, to recruit Richard Feynman, a move opposed for some reason by the department chairman, Raymond Birge. As Bernstein says, relations between Birge and Oppenheimer were strained. Bernstein may not know of their later reconciliation. In 1966, Oppenheimer, then dying of cancer, made a last trip to Berkeley. After a dinner at the Berkeley Faculty Club, Birge rose to salute Oppenheimer. You have to imagine Birge as he was then—a little old man in a dark, three-piece suit, with a bald, rather square head and a formal manner, and the last person in the world from whom you would expect much in the way of emotional display. Birge described what Oppenheimer had done for Berkeley, for the nation, and for physics; he then paused briefly and ended with the words, "And I love him."

Bernstein is so good at making a page turner out of a scientific advance that I wish he had told the story of Oppenheimer's role in grappling with the problem of ultraviolet divergences in quantum field theory. Oppenheimer had actually been the first to encounter one of those awkward infinities in a calculation of the effect of radiative corrections on the energy levels in atoms—essentially the same phenomenon that later became known as the Lamb shift. In reaction to these infinities and certain anomalies in cosmic-ray showers, Oppenheimer became a leading advocate of the idea that there is something fundamentally wrong with quantum electrodynamics, that it simply can't be trusted to describe physical processes at distance scales much less than 10^{-13} centimeters. His views are quoted by Robert Serber in *The Birth of Particle Physics* (Cambridge U. Press, 1983), edited by Laurie M. Brown and Lillian Hoddeson. Nevertheless, when it was discovered after the war that quantum electrodynamics gave perfectly sensible finite results if properly interpreted, Oppenheimer accepted this new view and hired Dyson, who gave the clearest exposition of how to deal with ultraviolet divergences, as a permanent member of the Institute for Advanced Study.

Oppenheimer never used his position of leadership in physics research to play the part of a mandarin who

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tries to control what other physicists do. In that regard, he presents a sharp contrast to Werner Heisenberg, a greater physicist, but one who did what he could after the war to force German physicists to work on his ideas. I am convinced that one of the reasons the US was successful in developing nuclear weapons during the war and Germany was not is that we had Oppenheimer while the Germans had Heisenberg.

Bernstein is even better in describing Oppenheimer's weaknesses. He offers an interesting explanation why General Leslie Groves in 1942 tapped Oppenheimer, who had never organized anything more complicated than a camping trip, to lead the secret nuclear weapons laboratory at Los Alamos rather than someone like E. O. Lawrence, who was accustomed to running a scientific laboratory. It was that Groves sensed in Oppenheimer a certain pliability, missing in Lawrence, that would allow Groves to have his way in running things. This pliability surfaced in Oppenheimer's willingness to have himself and all the other scientists at Los Alamos inducted into the US Army. Fortunately, the idea was dropped. As Bernstein notes, it would have been a disaster to try to put characters like Feynman in uniform. Oppenheimer did other peculiar things. He made a gratuitous and false comment to a security officer that Bernard Peters was a communist, and in his own security hearing he carelessly chose an attorney who had little experience in litigation.

About that security hearing, I agree with Bernstein that Oppenheimer was not only loyal (which was acknowledged in the hearing) but also not a security risk. An argument over this matter appeared recently in the pages of *The New York Review of Books* between Gregg Herken, who claims that Oppenheimer was a communist in the 1930s and early 1940s, and Daniel Kevles, who denies it. It is a fuzzy question. There is no question that Oppenheimer had friends who were communists, and for a while before he went to Los Alamos, Oppenheimer belonged to a small group of Berkeley faculty that, depending on how you look at it, can be regarded as a communist-party cell or a left-wing coffee klatsch. As far as I know, Oppenheimer never took orders from any communist organization. Certainly no evidence exists that he ever leaked anything to anyone. On the contrary, when his friend Haakon Chevalier tried to get Oppenheimer to pass on information about the Manhattan Project to George Eltenton, who had contacts at the Soviet consulate, Oppenheimer voluntarily reported Eltenton's name to a security officer. And although he tried at first to shield Chevalier, Oppenheimer eventually complied with an order from Groves and revealed Chevalier's role. (Oppenheimer said that Chevalier had approached him through Oppenheimer's brother Frank, a pointless lie that hurt him at his security hearing.) An FBI wiretap of the communist agent Steve Nelson heard Nelson complaining that Oppenheimer would not divulge any information. Furthermore, whatever sympathy Oppenheimer may have felt earlier for the Soviet Union was lost during the war, and he certainly had none for it in the 1950s. In her journal, Chevalier's wife recalls Oppenheimer telling Chevalier during the war that the Soviet Union was not to be trusted. The information about Oppenheimer's communist contacts that was dragged into the 1954 hearings had already been known when Oppenheimer had been cleared in 1947. Oppenheimer lost his clearance not because he was a security risk, but because Edward Teller and the US Air Force did not like the advice he was giving about nuclear-powered airplanes and the hydrogen bomb.

As Bernstein describes it, Oppenheimer's early life may have left him permanently unsure of himself. After a rather sheltered, well-off childhood, Oppenheimer went to Harvard at a time when the university was trying to cut down on the number of Jewish students, and he found himself pretty much a recluse there. Bernstein quotes a letter to home in which Oppenheimer gushes about his writing and reading and ends by wishing he were dead. As Bernstein rightly says, "The whole tone makes one's flesh creep." Oppenheimer's postgraduate time at Cambridge University was worse, and he suffered a nervous breakdown. His life became happier only when he met Max Born and found his vocation as a theoretical physicist.

Even his beginnings as a physicist left Oppenheimer with some unhappy memories. I remember that once as a postdoc at Columbia University, I was invited to give a talk at the Institute on some of my recent work. My talk was terribly formal, bristling with mathematical complications. Oppenheimer interrupted me and said that I reminded him of himself when he was my age. I stupidly blurted out "Thank you," to which he gravely replied, "It wasn't a compliment."

Spacetime and Geometry: An Introduction to General Relativity

Sean M. Carroll
Addison-Wesley, San Francisco, 2004. $85.60 (513 pp.). ISBN 0-8053-8732-3

Gravity: An Introduction to Einstein's General Relativity

James B. Hartle
Addison-Wesley, San Francisco, 2003. $59.80 (582 pp.). ISBN 0-8053-8662-9

One of the illustrations in *Alice's Adventures in Wonderland* shows Alice holding a large flamingo. Alice seems to be considering the questions, "What is this?" and "Now that I've got it, what do I do with it?" Students beginning the study of general relativity likely ask themselves the same questions about the spacetime metric, the covariant derivative operator, and the curvature tensor. Sean Carroll's *Spacetime and Geometry: An Introduction to General Relativity* and James Hartle's *Gravity: An Introduction to Einstein's General Relativity* are two new textbooks that present different pedagogical approaches to answering such questions, that is, to teaching general relativity.

Carroll's text adds a new option to the list of solid general relativity texts appropriate for graduate students planning to do research in gravity, high-energy theory, or both. Carroll presents a middle ground between a formal, mathematical introduction to general relativity and a utilitarian particle-physics presentation, the latter sidestepping the differential geometry involved in gravity. The student is led from manifolds through the curvature tensor to Einstein's field equations in a manner that is both correct and accessible. The exposition is aided by many examples that illustrate phenomena of interest, such as the expanding universe. A number of sections that treat more advanced topics appear in the first part of the text. For example, students read about causality in chapter 2. Rather than include several thorough chapters on causality, which would provide the background needed to read advanced papers or do research on the